

Biotechnology Innovations In Developing Nations

Biotechnology breakthroughs are coming from developing countries like China and India that are seeking a competitive edge in the world market. But will private investors step up to make it happen? Here are some reasons why they should.

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Traditionally, the United States has been viewed as the world leader in biotechnology innovation, with over 1,200 biotech companies employing almost 200,000 workers in fields ranging from human product development to food and agriculture services. Yet, as globalization becomes more prominent and technology spreads worldwide, other nations have come to the forefront of the biotech arena. Successful research and development in biotechnology is occurring in developing countries such as Brazil, China, Cuba, Egypt, India, Kenya, South Africa, and South Korea. Although these nations are at varying points in their respective economic development, each can be considered an “innovating developing country” in biotechnology with both public and

private industry support (Saha 2004). A focus on local health issues as well as national education and healthcare, government involvement, leveraging core competencies, and private sector funding are all key identifiable factors for success in many innovative developing countries, which speaks volumes about what it takes to be successful in burgeoning markets.

The biotechnology industries in the United States and Western Europe tend to focus on high-cost solutions for the kinds of chronic diseases that are predominant, namely, cardiovascular disease, diabetes, and tobacco-related conditions. Of the 1,393 new products marketed by Western biotechnology companies from 1975 to 1999, only 16 were for so-called “tropical diseases” and tuberculosis — the major public health issues in developing nations (Troullier 2002).

DEVELOPING COUNTRIES RESPOND

Not surprisingly, biotechnology industries in innovative developing countries have responded to public

health needs with extensive research in local health concerns. For example, sub-Saharan Africa has only about 10 percent of the world’s population but is home to more than 60 percent of the world’s HIV-infected population (UNAIDS/WHO 2004). As a result, most research efforts center on the development of a vaccine for HIV. South Africa is the only nation on the continent that is conducting clinical trials for HIV-candidate vaccines. This effort has been coordinated formally since 1999 by a joint government and private-sector initiative known as the South African AIDS Vaccine Initiative (SAAVI 2005).

Egypt was facing a shortage of insulin and an overdependence on the importation of insulin from overseas. A rapid development program sponsored by the government has allowed 90 percent of Egypt’s insulin to be produced domestically and has saved millions of dollars for the national health system.

Kenyan farmers are benefiting from the nation’s growing biotechnology sector, which has produced disease-free cotton and banana

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plants, made by laboratory tissue cultures, that offer greater yields. The plants were produced in local laboratories funded by joint public and private ventures (Koch 2004).

Cuba spun a meningitis B epidemic (more than 200 childhood deaths yearly in the 1980s) into a successful vaccine that, with its highly cost-effective hepatitis B vaccine, is exported by the World Health Organization (WHO) to developing nations worldwide (Carr 1999).

Though Western biotech companies have shied away from research in these fields due to concerns about poor market return and intense competition, the biotech industry in developing nations has taken up the WHO's charge of developing more effective treatments to address worldwide health concerns and food science issues (Ciccio 2004).

GOVERNMENT ACTION

A vital feature of all innovative developing countries' successes has

been government involvement as policymaker and architect, as well as funding partner. Surprisingly, the governments of most developing nations took an interest in biotech in the early 1980s, early in the infancy of the industry even in Western nations.

For example, India stressed the importance of developing its pharmaceutical and biotech sectors as early as 1980 in its sixth 5-Year Plan (Thorsteinsdóttir 2004a). India also created a Department of Biotechnology and invited international experts to serve on its oversight committee in an effort to maximize the use of government funds (Verma 2005).

Government resources devoted to the R&D of biotechnology and genomic products in South Africa are meager compared with Western countries, but the nation's leaders are committed to innovation and have made research a national priority. This approach has resulted

in strong governmental influence on the industry and an emphasis on top national concerns like HIV/AIDS research and infectious disease treatment (Burton 2002).

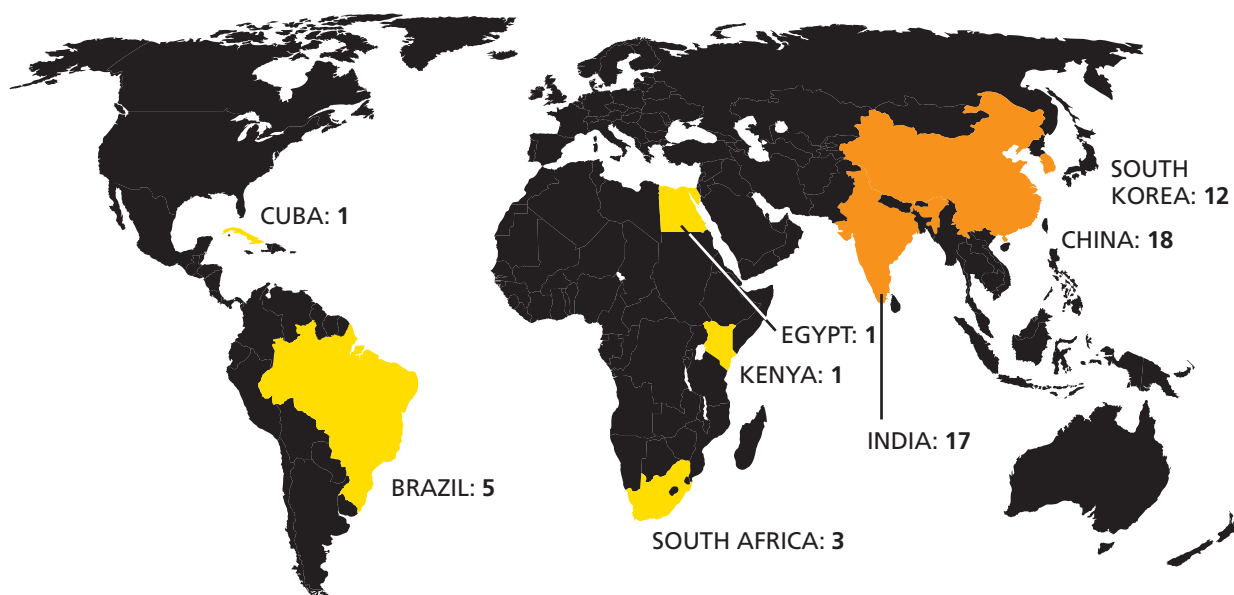
Another example is Egypt's National Strategy for Genetic Engineering and Biotechnology, a comprehensive plan to provide for the health of Egypt's citizens and to plot a course for the nation's expanding biotechnology industry that will ensure that its resources will be used effectively when crises arise in the future (Thorsteinsdóttir 2004a).

An involved and informed national government is key to the success of an innovative developing country's biotech sector, from a funding perspective and as a guiding hand to ensure the health of the industry.

RICH RESOURCES DEFINE NICHES

Innovative developing countries have successfully leveraged their

Number of biotechnology patents issued in 2005



SOURCE: USPTO 2005

natural resources and traditional industrial competencies to create a unique biotechnology sector. Brazil, for example, has used its vast size and abundance of natural resources from the Amazon rainforest to create a \$3 billion industry (2002 estimate) that closely links private companies, foreign investment groups, and university research centers. Brazil's animal health industry is the largest in Latin America and the fifth largest in the world, producing vaccines for farm and domestic animals that are used worldwide (Resende 2003).

Cuban scientists have tapped into their experience with sugar cane, a major cash crop, to create pharmaceutical agents that are derived from the plant — most notably PPG, a cholesterol-lowering agent that is exported to many developing nations (Carr 1999).

India has capitalized on its highly educated population and its large pool of well-trained, English-speaking science and technical experts to bring in foreign investment and to keep its highly skilled workers at home (Jayaraman 2004). Lax patent laws also have allowed Indian scientists to innovate with existing products by lowering production costs and adding value (Thorsteinsdóttir 2004a).

South Korea has built on its tradition of low-cost technologic innovation and an educated workforce to gain a competitive advantage. Its companies excel in the production of microarrays, biochips, and bioinformatics technologies — niche areas where skilled, experienced workers are able to leverage limited resources to obtain dramatic profits (Wong 2004).

In Egypt, expertise in plant biol-

ogy gained from past projects has allowed the initial development of a plant-based hepatitis B vaccine that is cheaper than the current vaccine and that may allow more widespread immunization (Ciccio 2004, Thorsteinsdóttir 2004a, WHO 2001).

By defining niche areas, developing countries have been able to attain a competitive advantage over Western companies and to continue strengthening their biotechnology fields.

HEALTH AND EDUCATION

A strong healthcare and educational system is also critical to development of a biotech industry. In Cuba, Fidel Castro's revolution ushered in an emphasis on science, education, and health (Thorsteinsdóttir 2004b). Cuba's health system and its research sector are intertwined; almost every health center is part of a national clinical trial program. And while Cuban hospitals generally suffer from a lack of money, supplies, and drugs, its citizens nonetheless enjoy a high standard of health in comparison to many developing nations, with the island boasting an average life expectancy of 76.7 years (UNDP 2004b).

The decentralization of China's educational system in the early 1990s, together with the traditional emphasis on merit-based promotion and the value of education, has fueled its biotechnological revolution with a vast educated workforce that has the skills needed for working in a demanding industry (Mok 1999).

China is just beginning to reap the benefits of its revamped educational system and should see more

benefits in the years to come. India similarly benefits from a cultural emphasis on education and the willingness of its youth to learn (Verma 2005).

PRIVATE-SECTOR SUPPORT

The importance of the private sector cannot be discounted when considering the biotech industry in developing nations. Government funding has been viewed as the primary source of capital for biotechnology research, but in many countries this is changing.

South Korea is the leader among innovative developing countries in terms of private-sector involvement. Government deregulation of the industry, coupled with extensive funding of technology transfer programs in public universities as well as the private sector through the 1999 Technology Transfer Promotion Act, has created a model that in many ways mirrors that of the United States (Wong 2004).

China, a nation not traditionally associated with private enterprise, has done an about-face in recent years, adopting a model that promotes free-enterprise creation. Public research institutions are being converted to private companies, with both researchers and professors at the helm (Thorsteinsdóttir 2004a). The change also is being fueled by citizens returning from abroad, many from Silicon Valley companies and tech-related positions to establish new ventures in their homelands (Saxenian 2001).

India's reputation as an outsourcing destination and generic-drug powerhouse is being leveraged to create a biotechnology sector that specializes in modifying exist-

ing chemical entities to create new genomic products (UNAIDS/WHO 2004).

An influx of investments in technology left over from the dot-com boom and a “re-immigration” wave of Indian nationals who have studied and worked abroad have combined to create explosive growth in the Indian biotech sector (Friedman 2005). These remarkable efforts highlight the powerful role that the private sector can play in promoting maintainable development and growth. They also are aligned with the goals for international development set forth by the United Nations Commission on the Private Sector and Development (UNDP 2004a).

Not every innovative developing country is strong in each of the five areas examined in this article (local response, government action, resources, health and education, and private-sector support), which are important drivers in innovative developing country biotechnology development. But success within these areas in some innovative developing countries illustrates that innovation is not limited to Western nations; even countries without vast resources can be innovative in a highly technical and competitive field.

CONCLUSION

The explosion of biotechnology papers and publications that is coming from nations in Asia, Africa, and Latin America in recent years is no accident, and policymakers in the international community will want to consider this fact carefully. Developing nations are working hard to close global health disparities and to reduce health inequali-

ties with innovative products that rival the best that the Western world has to offer.

The examples discussed above serve to show that human ingenuity knows no borders, and that innovative developing countries are making a significant impact on the global marketplace. **BH**

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